

E4: Energy Efficiency Expert Evaluation

Today we are sharing a process called the Energy Efficiency Expert Evaluation, or E4 for short. It is a step-by-step energy assessment process that helps identify and prioritize energy conservation measures that help enhance building efficiency. These measures improve the environment and reduce energy and associated greenhouse gases, while saving taxpayer money.

This training video will provide a basic understanding of E4 assessments. You will hear from the experts who developed and refined the process as well as facility managers who have used and benefitted from these assessments. The training will also direct you to the information and resources needed to help get everything started.

As you know, the Federal government is the single largest energy consumer in the nation, and spends more than \$14.5 billion each year on energy needs. The E4 process helps facility managers and other building personnel work toward meeting mandates included in Section 432 of the Energy Independence and Security Act of 2007, also known as EISA, as well as help improve and maintain ongoing efficient operations.

We hope you find this training informative. Please do not hesitate to contact DOE with any questions or comments. We look forward to hearing from, and working with all of you.

E4 stands for Energy Efficiency Expert Evaluation. It's an innovative, multi-disciplinary process to engage energy experts and facility personnel in a team approach to improve operational performance and achieve significant cost savings.

The E4 process was successfully introduced in 2007 by the Department of Energy's Federal Energy Management Program.

The E4 process combines the most practical elements of an energy audit and retro-commissioning. It is an intensive on-site workshop facilitated by a team of energy experts, and typically lasts two to four days. While on site, the team interacts with facility and energy managers, employees, and building occupants to pinpoint problems and find solutions to reduce energy use, cut operational costs, and reduce greenhouse gas emissions.

E4s are effective because they don't focus on symptoms alone – they locate and uncover the root causes of energy waste. The holistic team approach brings together professionals with differing perspectives so they can identify widespread problems and collaborate on low-cost, no-cost solutions.

The E4 final report can also support and justify large capital improvements that may require additional project funding through ESPCs, UESCs, or PPAs.

The E4 site visit is comprised of four phases. Each one has a specific purpose that contributes to overall success.

We do sort of a hybrid type of evaluation. It's part energy audit, part retro-commissioning. And that is really by design, as part of the E4 evaluation. The retro-commissioning actually looks at the output of the equipment itself and might not necessarily be concerned with building envelopes or walking through and looking at lighting efficiencies or how the spaces are actually saving energy.

The energy evaluation and audit will actually look at a much broader picture and not quite so much on pinpointing the output of the equipment.

The energy audit is more general in nature. You're looking at the overall space conditions and other factors like lighting in elevators. If you're doing retro-commissioning you're not necessarily looking at things like that. Retro-commissioning is a lot more equipment-specific. You're concentrating on what the output of the equipment is, whether or not it's operating the way that it was intended and as efficiently as it possibly can.

Phase 1: Planning

Before on-site work begins, the E4 team first conducts the Planning Phase. At this time, facility management determines project objectives, gathers and reviews documents, and assembles a project team.

The E4 team looks at where problems have occurred, prioritizes objectives, and identifies key performance goals.

These objectives determine whether the E4 team is made up of in-house personnel or outside consultants. Either way, an E4 team should be multi-disciplinary and include professionals with complimentary skill sets and perspectives.

An in-house team should include experienced senior staff members who have access to all buildings, control systems, and records. At large, high-tech, or specialized facilities such as laboratories, it may be useful to contract with an independent third-party agent who can provide specialized expertise and help identify projects that may have been overlooked by on-site staff.

After the team is established, its first task is to collect and review a set of current, comprehensive, and accurate facility documents. These include utility bills, energy intensity baseline data, architectural and engineering documents, and operations and maintenance manuals and records. The more information that can be provided in advance the more time it will save on-site. Once this initial collection and review is complete, on-site work begins with the kick-off discovery meeting.

Phase 2: Discovery

The E4 process begins on-site with a Kick-off Meeting to familiarize the team with the facilities they are about to inspect, and review operational issues that facility management would like to address.

The Kick-Off Discovery Meeting is the most important part of the entire E4 process. What we do is morph into a survey or questionnaire that we had sent out to the sites previously, and they filled out. We use this questionnaire and the survey as talking points. At first the survey questions are very general in nature – things like, How much energy do you use? - How many floors does the building have? - How old is the building? Then we start getting a little bit more specific in the questions and we start asking things like, What's the biggest problem in the building? Typically, everybody comes back and says, oh, it's hot and cold spots or things of that nature.

What active listening is, we hear different perspectives. Our team normally consists of a project manager, mechanical engineers, control engineers, and maybe others. As a result we all have a different perspective as to what we're trying to listen for. Before you know it, by the time we're out of the meeting, we have a very good feel, from the people who were there, as to where the problems are, what their biggest issues are, what the history of the building is; whether or not the building itself had prior lives; and whether or not the motors are premium efficiency motors. It's all these different points that steer us to where we have to go later on during the evaluation, when we're actually visiting the buildings and going through.

The Kick-off Discovery Meeting is followed by a brief "windshield tour". Here the team gets an initial, first-hand look at the facilities they've reviewed in photographs and documents. Here, the team members are on the lookout for telltale signs of big problems – like workers with personal space heaters or fans in their offices – signs that the HVAC system is not working the way it should.

Again, we'll be doing a training, so we want to make sure that we're talking to the subject. We want to see how old the building is, how big it is. We want to see what groups of people are working in the buildings so that if, during the training, we're talking about a warehouse facility, it is in fact a warehouse facility and not a laboratory that we're going to be evaluating.

Phase 3: Corrective Measures

The E4 team usually offers to conduct a customized training session tailored to the facility's interests in preventative and corrective maintenance. This training is often held before the in-depth site inspection begins.

We tell them how to set and accomplish their objectives, who should be on the commissioning team, and what the final product will look like. We walk through the process as to how we would go about doing the retro-commissioning or the audit,

starting with the survey, going on to the classroom sessions, the interviews, walk-throughs - the whole process. We talk about the ECOs, Energy Conservation Opportunities, and ECMs, Energy Conservation Measures that might be recommended.

This type of “train-the-trainer” orientation underscores that group training is a continuous process that needs to carry on after the E4 team leaves the site.

At the lab we really have a full team effort on energy conservation between facilities, and environmental, and upper management. They see the energy bills and know they are increasing. They know the greenhouse gas metrics that we report on. They know the thousands of BTUs per square foot that we report on, and they see the costs. So it's really important that it's a team effort, because not one individual “energy manager” is going to get this all done by themselves.

The training is also a good time to discuss what to expect during the visit and how to move forward with implementing the E4 team’s final recommendations.

After the training session, the E4 team begins an in-depth inspection of buildings and equipment. The team walks the site, examines building features, including equipment, technologies, and signs of operations and maintenance practices.

The team typically begins by inspecting the largest systems with the greatest potential for savings, such as HVAC and electrical systems.

In the mechanical rooms we want to be able to look at the HVAC equipment, and some of the electrical panels. We’ll have our thermography guns with us and look for hotspots on the electrical.

Regardless of the facility’s size or type, the E4 team utilizes proven diagnostic methods.

One root cause of problems at many Federal facilities is that their use and mission have changed several times over the years. A facility originally built as a lab may have been renovated into open-bay offices, and later reconfigured to some other use. While the interior workspaces are redesigned, the mechanical systems that serve them often are not. This results in spaces that are over or underserved by the building’s systems.

By the end of its site inspection, the E4 team has collected the data, taken measurements, and observations it needs to produce a final report.

Phase 4: Project Hand-Off

Right after the site inspection, while observations are fresh, the E4 team gathers to develop a preliminary short list of findings and improvements.

Typically what we do is we go back to the hotel and our team will brainstorm what we observed during the day. The four of us will sit down and throw out ideas and

observations and talk about the solutions to the problems that were identified, usually by the technician that's so familiar with the building, as well as the occupants too.

In the afternoon we'll go back and we'll develop a shopping list, you might say, of ECMs, Energy Conservation Measures, where we just list simple statements, simple lines that say - upgrade motors to premium efficiency motors, for example.

Initial findings are then organized, and the team presents a preliminary list of recommendations to management.

I always make it a point that they understand that these are just preliminary ideas, first of all, and some may drop out once we go back to the office and we start doing the analysis and the evaluation. Some of these will fall out, several of them will be combined and consolidated, and we might even add additional ideas, as we go back, and say, "You know, we never really thought of that. Let's go ahead and add that in."

The final report is divided into five parts, organized to help facility management understand where to concentrate their efforts. The top priority is often set on no-cost/low-cost improvements that see quick paybacks.

The final report summarizes all background information, inventories major systems and equipment, and provides a detailed analysis of data taken from building diagnostic scans and tests.

The final Appendix contains the calculations and assumptions used by the team to determine its recommendations. This section also includes citations and other documentation for easy reference.

In addition to low-cost, no-cost solutions, the final report often provides the facility with a basis to justify larger projects, such as full-scale retro-commissioning and capital improvement projects.

It's a good idea to have those items ready to go— your estimated savings documented, your estimated cost for the system documented, and your return on investment, simple payback— Items such as that. Then you have that ready to go if the funding does become available, you have projects that are ready to be applied for.

Since we are the Department of Energy we should be an example of how you can be the most energy efficient operation you can possibly be. It saves you money, it reduces pollution, and it protects the environment; it's a triple win.

Leading by Example requires a strong commitment and an expert knowledge. At the Department of Energy, we offer many tools and resources to help Federal facilities successfully implement energy-saving projects, and create efficient and sustainable buildings and campuses. On the FEMP website, you will find training courses, interactive tools, resource documents, and case studies. FEMP experts are also

available to answer your questions and provide further assistance.

The E4 process is a proven method to improve energy efficiency and save energy at facilities of all sizes. We hope all Federal agencies will take advantage of this successful model. While the challenge before us is great, so is the opportunity to make a difference.